DOCUMENT RESUME

ED 286 214 CS 505 616

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TITLE Beyond Hage: Building Communication Theory by Exploring Three-Variable Relationships.
PUB DATE May 87
NOTE 23p.; Paper presented at the Annual Meeting of the International Communication Association (37th, Montreal, Quebec, Canada, May 21-25, 1987).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Communication (Thought Transfer); Communication Research; *Hypothesis Testing; Methods Research; Predictor Variables; *Research Design; *Research Methodology; *Research Problems; Speech Communication
IDENTIFIERS *Variables

ABSTRACT

Building communication theory in terms of three-variable relationships is a promising route to developing better theory, because three-variable relationships stand midway between sometimes overly simplistic two-variable relationships, and the more complex path analysis. The analysis of three-variable relationships has been done in many previous research studies, but often under the rubric of "controlling for a spurious relationship." Several other important purposes in theory-building can be served by formulating and investigating three-variable relationships, including the identification of intervening processes and the specification of conditions for an effect to occur. Possible outcomes of three-variable analysis are (1) explanation, (2) internal replication, (3) interpretation, (4) interaction, and (5) additivity. Forms of three-variable hypotheses that do not seem workable include mainstreaming hypotheses, and knowledge gap hypotheses, while hypotheses with very explicit statements of the relationship between variables x and y for each condition of variable z are the types that should be more successful. With three-variable analysis, researchers must take care to replicate their results and avoid post hoc reasoning. (SKC)

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ED286214

Beyond Hage: Building Communication Theory By Exploring Three-Variable Relationships

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Beyond Hage: Building Communication Theory
By Exploring Three-Variable Relationships

This paper argues that building communication theory in terms of three-variable relationships is a promising route to developing better theory. Three-variable relationships stand midway between two-variable relationships, which are probably too simplistic, and path analysis, which can be extremely complex. The analysis of three-variable relationships has been done in many previous research studies, but often under the rubric of "controlling for a spurious relationship." This paper argues that several other important purposes in theory-building can be served by formulating and investigating three-variable relationships, including the identifying of intervening processes and the specifying of conditions for an effect to occur. Five different possible outcomes of three-variable analysis are discussed, and advice is given on putting three-variable hypotheses in a proper form. Some methodological cautions are also provided.

Beyond Hage: Building Communication Theory
By Exploring Three-Variable Relationships

A frequent occurrence in communication research is to begin a line of inquiry with a hypothesis of broad, across-the-board effects, only to find later in subsequent research that the effect is not general but occurs only under certain conditions. What started out as a clean, neat two-variable hypothesis becomes qualified. The hypothesis is no longer parsimonious; it needs to have qualifying phrases tacked on. And it is no longer as general, and, therefore, not as potent; it only holds up in certain situations.

Meadow appears to have been referring to this occurrence when he wrote, "After four decades of exploration, we are left with one answer to the question of media effects -- 'it depends'."[1]

Faced with this happening, it is easy to imagine a process with no end. Will further research uncover still more qualifying variables, until it takes knowledge of 50 variables to make a prediction and only a computer can handle the complexity?

Meadow is right, of course, but his conclusion should not be the basis for throwing up our hands in despair. In fact, another point of view is that this is just the place at which things get interesting. As we find out more about the details of these dependencies, we are finding out something about the complexities of human communication and the variables that make a difference. The

proof of the pudding is that knowledge of the dependencies or the contingent conditions often lets us make more accurate predictions about communication outcomes.

In short, there's a big difference between saying "It depends, but I don't have any idea on what," and "It depends, and the two or three most important variables it depends on are X, Y and Z."

Part of the solution to this dilemma may lie, as it often does, in taking a middle course. On the one hand, two-variable relationships are probably too simplistic. On the other hand, 50-variable relationships are probably too complicated. Even a path model with just five variables can be so complex that it is difficult to understand. But fortunately there is a range of possibilities in between these. What might make sense as a research strategy is to do some serious work at this point on three-variable relationships, the next level of complexity beyond two-variable relationships. As we shall see, this next step increases the complexity quite a bit. And it seems like a natural step in that it takes us beyond Hage, whose valuable book Techniques and Problems of Theory Construction in Sociology deals mostly with two-variable relationships.[2]

Furthermore, it may not be necessary to study a huge number of variables all at once. As Hirschi and Selvin have noted, "The increasing success of the life sciences in understanding the human body (surely more highly integrated than the social system) suggests that good research is possible without taking everything into account at once."[3]

This paper attempts to take the next step in theory-building in the mass communication theory area beyond the steps recommended by

Hage. Hage's book focuses on two-variable theoretical statements, for which he recommends the form: "The greater the X, the greater the Y."

Hage acknowledges the importance of relationships that are more complicated than two-variable relationships, but he doesn't do very much to deal with them. He writes:

> Through our discussion, we have been concentrating on the problem of interrelating just two variables. In practice, we can and do expect our operational linkages to be more complex than this. The diagrams and forms refer to the effect of X on some Y where X can be a combination of variables.[4]

The idea that X can be a combination of variables oversimplifies the complexity of even a three-variable relationship quite a bit. As we shall see, a set of three variables can be related in five distinctive ways. The situation would become even more complicated with more than three variables.

Of course, it is a common research strategy to introduce a third variable as a control variable while exploring a relationship. The usual reason for doing this is to test whether a relationship is spurious or not. This is indeed an important reason for introducing a third variable. Actually, however, there are at least two other important roles that exploring three-variable relationships can play in the development of communication theory.

One of these important roles is specifying the ways that a hypothesis expressing a relationship between two variables either holds up or does not hold up depending on the state of a third

variable. This is sometimes spoken of as specifying the "contingent conditions,"[5] or as exploring "contingent causation."[6]

As Chaffee says, "Physically partitioning samples on the basis of contingent orientations that are necessary for a media effect to operate is likely to become more common in future research; this trend is a sign both that we understand quite a bit about the total influence process and that we are going to be able to learn more."[7]

An example of a study which specified contingent conditions for communications effects to take place is Hill's study of agenda-setting by television news.[8] He found agenda-setting effects are more likely when viewers have prior awareness of news topics through print media exposure or have some college education.

The other major role that exploring three-variable relationships can play in building communication theory is in clarifying causal relationships by showing the operation of intervening variables. This is the process of analysis that Hyman has called interpretation.[9] Commenting on the area of mass media effects research, Chaffee states, "What has been lacking, although it too is beginning to accumulate, is three-variable research in which the psychological processes that intervene between media exposure and its effects are studied."[10]

Chaffee gives an example of a research area where there is a need for interpretation. He cites the finding that a boy is shown a filmed fight and subsequently acts more aggressively than before. We might conclude that the film has had an effect, but we might not understand the intervening psychological process that led to this effect. In this example, there are several possible intervening

processes -- the boy may be imitating the behavior he has seen; the boy may be "identifying" with the grown, strong man who was fighting; or the film may have <u>aroused</u> him to do something physically active, and any kind of activity may have reduced that state of arousal.11 We don't know which of these possible interpretations is correct until we do some additional three-variable studies.

To take another example, interpretation could be useful in clarifying our understanding of how agenda-setting works. We don't really know much about the process by which the play of news items in the media gets translated into a set of priorities in an individual's mind. One possibility -- and this is only one of many -- is that the public has a good understanding of journalism and interprets the cues of news play as indicators of importance. This could be tested by introducing "understanding of journalism conventions indicating story importance" as a third variable. This could be measured by having survey respondents indicate their agreement on five-point Likert scale with statements such as the following:

"If a news story is on the front page of a newspaper, it is important."

"The most important stories in a television newscast come at the beginning of the newscast."

Once these variables have been measured in an agenda-setting study, they can be used as a third variable in the kind of three-variable cross tabulation analysis to be discussed below.

There are many other good candidates for variables that would help us understand the agenda-setting process by using a third variable to interpret the two-variable agenda-setting relationship.

An excellent place to focus one's theory-building efforts is to think of possible variables of this type, figure out how to measure them, and then conduct a study in which they can be introduced as third variables along with the two principal variables of the agenda-setting process (the media agenda and the public's agenda).

Five Types of Outcomes

We have been focusing on a general research strategy in which two variables are cross-tabulated, and then a third variable is introduced. This strategy has been referred to as elaboration by Lazarsfeld,[12] who did much of the work to develop it. The strategy is discussed thoroughly in Hyman's Survey Design and Analysis,[13] as well as other places. Actually, there are a number of possible outcomes of this kind of analysis. Lazarsfeld,[14] as well as Hirschi and Selltiz,[15] indicate that there are four. But there appear to be five significant ones.

In the following discussion of this kind of analysis, the terms independent variable and dependent variable will be used, even though the variables are not necessarily being manipulated in an experiment. Independent variable will be used to refer to the variable thought to be the causal variable. Dependent variable will be used to refer to the variable thought to be caused, or to be the effect.

1. Explanation. Explanation is one of the possible outcomes of three-variable analysis discussed by Hyman. Explanation occurs when the third variable is causally prior to the independent variable, and the third variable accounts for the original relationship (see

Table 1). In this situation, we conclude that the original relationship was spurious, and we discard the original relationship. This is not a total loss, however, because we have learned something about the causal relationship. We have learned that the third variable is a more plausible cause of the dependent variable than the original independent variable.

2. Internal Replication. This term appears to have been introduced by Hirschi and Selvin.[16] Internal replication occurs when the third variable does not affect the original relationship (see Table 2). In this case, we conclude that the third variable is not an important variable in this relationship. Our faith in the original two-variable relationship becomes strengthened because we have ruled out one possible alternative hypothesis.

3. Interpretation. This is another of the outcomes discussed by Hyman. Interpretation takes place when a third variable occurs in sequence between the independent variable and the dependent variable, and the third variable accounts for the original relationship (see Table 3). Note that interpretation and explanation differ only in the time sequence or causal sequence that is attributed to the variables, and that this is something that the researcher determines. In many cases it may be very clear which variable occurs first in a causal sequence, but in other cases it may be a matter of debate.

4. Interaction. This is a term from analysis of variance meaning that the relationship between one variable and another variable is dependent on the value or level of a third variable (see Table 4). This is the frequent situation in social science research that elicits the "it depends" conclusion. This outcome helps the

researcher to specify the contingent conditions under which a relationship holds up. Hirschi and Selvin indicate that this is the most common outcome of introducing a third variable.[17] They point out that Hyman used the term specification for a particularly strong interaction -- one in which one partial relationship is stronger than the original relationship, or perhaps opposite in sign.[18]

5. Additivity. Additivity occurs when both the independent variable and the dependent variable affect the dependent variable, but the effects are independent and the variables do not interact (see Table 5). In the terms of analysis of variance, this is the situation in which you have two main effects but no interaction. This is the outcome which, although quite common, has tended to be overlooked in some discussions of three-variable relationships.

We have been focusing on the use of cross-tabulations. Of course, three-variable relationships can be explored by other means besides cross-tabulation tables. One of these is bar graphs (which are used frequently by Gerbner in presenting the result of his cultivation research[19]). Another is partial correlation. Analysis of variance with factorial designs can also be used. Partial correlation is probably the most common technique. One disadvantage of partial correlation is that it is more ambiguous than cross-tabulation. You can't see much of what is going on. Unfortunately, the temptation to use partial correlation appears to be strong. One reason is that it is made so easy by the computer. Another method of examining three-variable relationships is by looking at correlation coefficients within subgroups. An example of this technique appears in O'Keefe's study of the effectiveness of a mass media crime prevention program.[20]

This technique has some of the advantages of partial correlation -- there are fewer numbers to look at in a table and the computer can do a lot of the work for you -- and some of the advantages of cross-tabulations -- namely, that you can see which of the five types of three-variable relationships you have.

Proper Form for Hypotheses

The recommendation of studying three-variable relationships raises an important question -- what is the proper form of hypotheses for three-variable relationships? These hypotheses tend to be more complicated than two-variable hypotheses. In fact, they are often so complicated that they are difficult to put into words. For instance, here is Gerbner et al.'s statement of their "mainstreaming" hypothesis: "By 'mainstreaming' we mean the sharing of that commonality among heavy viewers in those demographic groups whose light viewers hold divergent views."[21] This is three-variable hypothesis, with the phrase "demographic groups" covering a number of different possible third variables. But it is difficult to draw in advance the bar chart that would illustrate a result that would fit the hypothesis.

Another well-known hypothesis that is a three-variable one is the "knowledge gap" hypothesis. As stated in the original article by Tichenor, Donohue and Olien, the knowledge gap hypothesis takes this form:

> As the infusion of mass media information into a social system increases, segments of the population with higher socioeconomic status tend to acquire this information at a

> faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease.[22]

This statement of the knowledge gap hypothesis is probably about as clear as it can be, but it is noteworthy that it is 49 words long and that a diagram is almost necessary to show just what is meant.

Several forms of hypotheses that we sometimes see presented do not seem to be adequate. For instance, it is not enough to predict that "there will be an interaction." A number of different patterns of interaction are possible, and this kind of statement does not specify which one.

An example given by Hage also does not seem to suggest a workable general form for a three-variable hypothesis. Hage presents this hypothesis: "The lower the education, when there is little or no income, the lower the power."[23] But this statement leaves out half of the full three-variable table -- the half corresponding to the condition of high income.

What seems to be needed in a hypothesis for a three-variable relationship is a very explicit statement of the expected relationship between variables X and Y for each condition of variable Z. The hypothesis can almost mirror the form of a table showing a three-variable relationship. For instance, here is an explicit statement of the kind of prediction one might make for a familiar attitude change experiment:

> When audience members are high in education, a two-sided message will lead to more attitude change than a one-sided message, but when audience members are low in education, a

two-sided message will lead to less attitude change than a one-sided message.

The above hypothesis is also somewhat long, but such length may be necessary to deal with the complexity of a three-variable relationship.

Some Methodological Considerations

A few methodological warnings seem in order for researchers working on three-variable relationships. As more analysis by subgroups is done, replication probably becomes more important -- to show that differences between subgroups aren't due merely to sampling error. Also, there is another danger in looking at differences between subgroups -- the danger of post hoc reasoning. One of the problems with post hoc reasoning is that it can mean that nothing is ever falsified. Instead of falsifying a hypothesis, we qualify it. For instance, a researcher might start out with a hypothesis that a certain general effect will occur. In various studies of the hypothesis, however, it might happen that the hypothesis is supported in some studies while its logical opposite is supported in other studies. The tendency in these cases seems to be not to conclude that there is evidence contrary to the original hypothesis but to revise it to state that the outcome is dependent on a third variable. While this procedure is essentially the approach being presented in this paper, it does raise some questions. Falsification, as used by Popper,[24] and strong inference, as used by Platt,[25] don't seem possible with this approach.

Three-variable analysis as a strategy is applicable to either

survey research or experiments. It may even be suitable for content analysis, if the object of the content analysis is to test hypotheses about causal relationships.

One of the goals of this paper is to point out that several important purposes in theory building beyond just checking for a spurious relationship can be served by introducing third variables into an analysis. As Kidder has pointed out, "Choosing variables to introduce as control variables in a data analysis is a theoretical issue."[26] In other words, in many situations there are numerous variables that one could select as a third variable, and there are several purposes in theory-building that could be served by selecting each. So the process should not be a mindless one, and it requires some knowledge of theory.

Conclusion

Much of our communication theory seems to be marked by a shift from statements of very general relationships between two variables to more qualified statements of when effects are likely to occur. In general, we're moving away from a strong effects model of mass media and toward a contingent effects model. The conclusions we are reaching seem to be similar to the conclusion Roger Brown drew some years ago about the effectiveness of the propaganda devices -- that they are "contingently rather than invariably effective."[27]

Three-variable analysis is highly suitable for this kind of theory development. It seems to be the next logical step beyond Hage's two-variable approach.

NOTES

1 Robert G. Meadow, "Political Communication Research in the 1980s," Journal of Communication 35:158 (Winter 1985).

2 Jerald Hage, Techniques and Problems of Theory Construction in Sociology (New York: Wiley, 1972), p. 32.

3 Travis Hirschi and Hanan C. Selvin, Delinquency Research: An Appraisal of Analytic Methods. (New York: The Free Press, 1967), p. 22.

4 Hage, op. cit., p. 109.

5 James P. Winter, "Contingent Conditions in the Agenda-Setting Process," in Mass Communication Review Yearbook, Vol. 2, ed. by G. Cleveland Wilhoit and Harold de Bock (Beverly Hills, Cal., 1981), p. 236.

6 Steven H. Chaffee, "Mass Media Effects: New Research Perspectives," in Communication Research -- a Half-Century Appraisal, ed. by Daniel Lerner and Lyle M. Nelson (Honolulu: University Press of Hawaii, 1977), p. 226.

7 Ibid, p. 227.

8 David B. Hill, "Viewer Characteristics and Agenda Setting by Television News," Public Opinion Quarterly 49:340-350 (Fall 1985).

9 Herbert Hyman, Survey Design and Analysis: Principles, Cases and Procedures (Glencoe, Ill.: The Free Press, 1955), p. 276.

10 Chaffee, op. cit., p. 222.

11 Ibid.

12 Paul F. Lazarsfeld, "Foreword," in Herbert Hyman, Survey Design and Analysis: Principles, Cases and Procedures (Glencoe, Ill.: The Free Press, 1955), p. xiv.

13 Hyman, op. cit.

14 Lazarsfeld, op. cit.

15 Hirschi and Selvin, op. cit., p. 99.

16 Ibid.

17 Ibid, p. 47.

18 Ibid, p. 111.

19 For example, see George Gerbner and Larry Gross, "Living With Television: The Violence Profile," Journal of Communication 26:173-199 (Spring 1976); George Gerbner, Larry Gross, Michael Morgan and Nancy Signorielli, "The 'Mainstreaming' of America: Violence Profile No. 11," Journal of Communication 30:10-29 (Summer 1980).

20 Garrett J. O'Keefe, "'Taking a Bite out of Crime': The Impact of a Public Information Campaign," Communication Research 12:147-178 (April 1985).

21 George Gerbner, Larry Gross, Michael Morgan and Nancy Signorielli, "The 'Mainstreaming' of America: Violence Profile No. 11," Journal of Communication 30:15 (Summer 1980).

22 P. Tichenor, G. Donohue and C. Olien. "Mass Media Flow and Differential Growth in Knowledge," Public Opinion Quarterly 34:159 (Summer 1970).

23 Hage, op. cit., p. 94.

24 Karl Popper, The Logic of Scientific Discovery (New York: Harper & Row, 1965), p. 42.

25 John R. Platt, "Strong Inference," Science 146:347-353 (October 16, 1964).

26 Louise H. Kidder, Seltiz, Wrightsman and Cook's Research Methods in Social Relations, (New York: Holt, Rinehart and Winston, 1981), pp.

76-77.

27 Roger Brown, Words and Things (New York: The Free Press, 1958), p. 306.

Table 1

Explanation

	Single	Married
Eat Candy Regularly	75%	63%
Doesn't Eat Candy	25	37
	100%	100%
	(999)	(2010)

	Up to 25		25 and Over	
	Single	Married	Single	Married
Eat Candy Regularly	79%	81%	60%	58%
Doesn't Eat Candy	21	19	40	42
	100%	100%	100%	100%
	(799)	(503)	(200)	(1507)

Adapted from Hans Zeisel, Say It With Figures, 5th ed. (New York: Harper & Row, 1968), p. 139.

Table 2

Internal Replication

	Light Viewers	Heavy Viewers
TV Answer*	50%	59%
Other Answer	50	41
	100%	100%

	Over 30		Under 30	
	Light Viewers	Heavy Viewers	Light Viewers	Heavy Viewers
TV Answer*	49%	58%	52%	63%
Other Answer	51	42	48	37
	100%	100%	100%	100%

* Gave the "TV answer" to a question about the proportion of people employed in law enforcement.

Adapted from George Gerbner and Larry Gross, "Living With Television: The Violence Profile," Journal of Communication 26:192 (Spring 1976).

Table 3

Interpretation

	High Education	Low Education
Favor the draft	88%	70%
Oppose the draft	12	30
	100%	100%
	(1761)	(1876)

	Friends Deferred		Friends Not Deferred	
	High Education	Low Education	High Education	Low Education
Favor the Draft	63%	63%	94%	95%
Oppose the Draft	37	37	6	5
	100%	100%	100%	100%
	(335)	(1484)	(1426)	(392)

Adapted from Herbert Hyman, Survey Design and Analysis: Principles, Cases and Procedures (Glencoe, Ill.: The Free Press, 1955), p. 279.

Table 4

Interaction

	Low Education	High Education
Favor Nuclear Freeze	63%	76%
Oppose Nuclear Freeze	37	24
	100%	100%

	Liberal		Conservative	
	Low Education	High Education	Low Education	High Education
Favor Nuclear Freeze	69%	90%	53%	57%
Oppose Nuclear Freeze	31	10	47	43
	100%	100%	100%	100%

Adapted from James W. Tankard, Jr., "Knowledge and Opinion on the Nuclear Freeze: A Test of Three Models," unpublished paper presented to the Communication Theory and Methodology Division, Association for Education in Journalism and Mass Communication, Corvallis, Oregon, August, 1983.

Table 5

Additivity

	Light Viewers	Heavy Viewers
TV Answer*	50%	59%
Other Answer	50	41
	100%	100%

	Males		Females	
	Light Viewers	Heavy Viewers	Light Viewers	Heavy Viewers
TV Answer*	42%	51%	57%	66%
Other Answer	58	49	43	34
	100%	100%	100%	100%

* Gave the "TV answer" to a question about the proportion of people employed in law enforcement.

Adapted from George Gerbner and Larry Gross, "Living With Television: The Violence Profile," Journal of Communication 26:192 (Spring 1976).